CEMENT AND LIME MANUFACTURE

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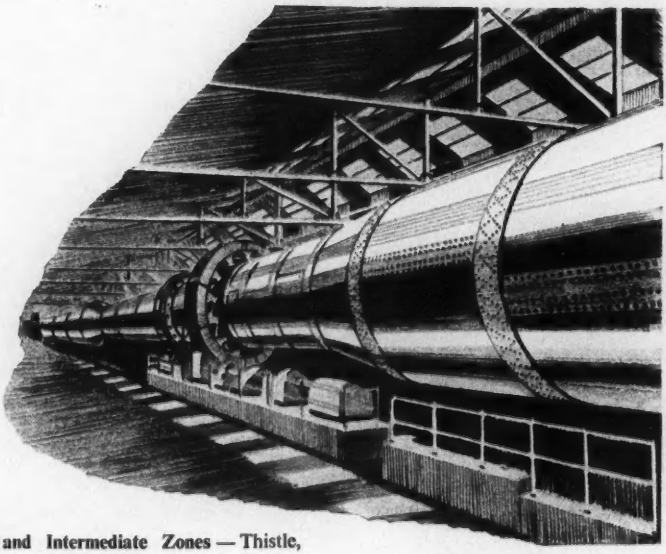

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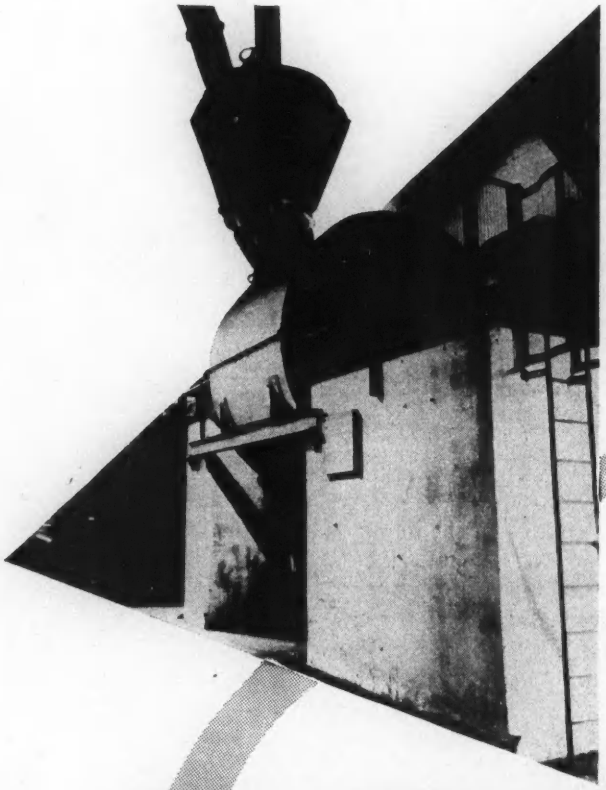

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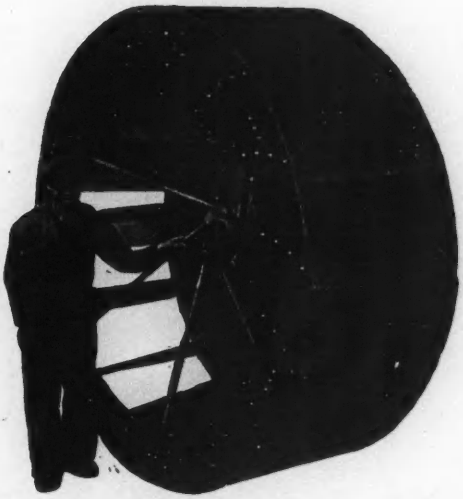

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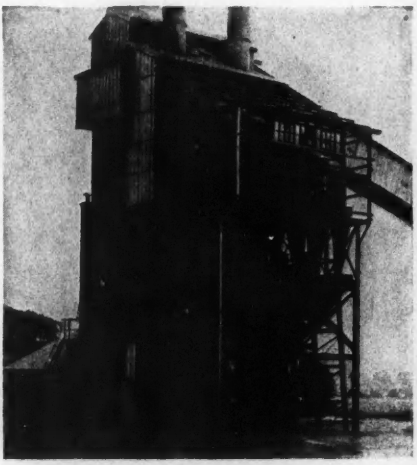

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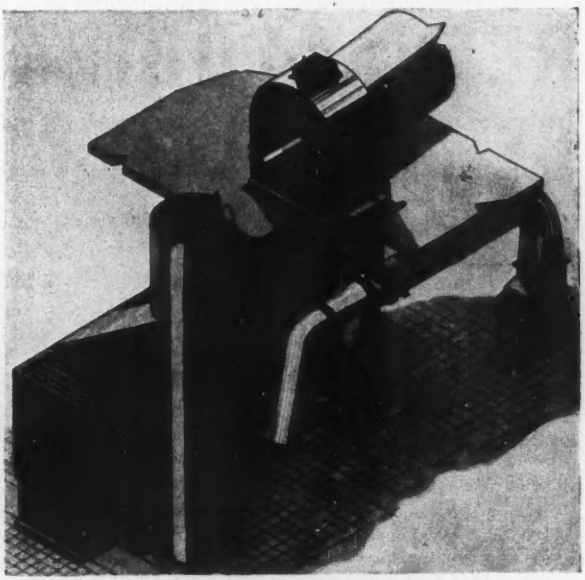
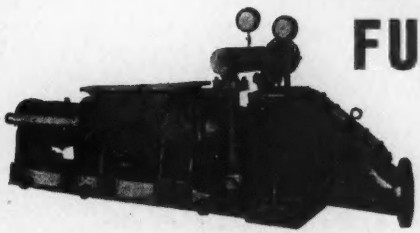


(British Patents Nos. 519,018, 519,057, 580,583, 611,296).



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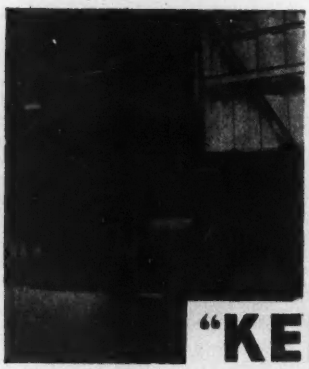

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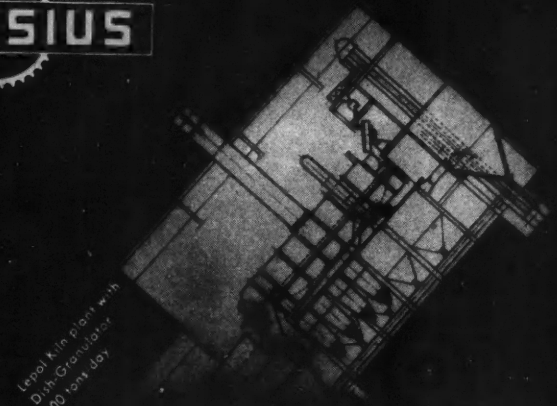

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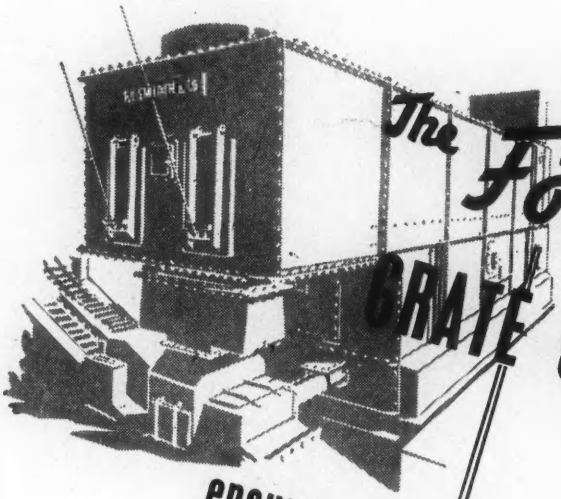

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Bamberton Cement Works, British Columbia.

THE British Columbia Cement Company, Ltd., at its works at Bamberton, British Columbia, Canada, has recently installed new equipment which has increased its yearly output from about 200,000 tons to about 370,000 tons of Portland cement. The new works cost about £720,000 and was completed in just under two years. A 350 ft. by 10 ft. kiln, manufactured by Vickers-Armstrongs, Ltd., is the main item of new equipment, and the new raw material preparation and cement finishing plant has been installed to deal with the increased clinker production. The works (*Figs.* 1 and 3) is on Saanich Inlet, Vancouver Island, 20 miles from

Fig. 1.—View from the Sea.

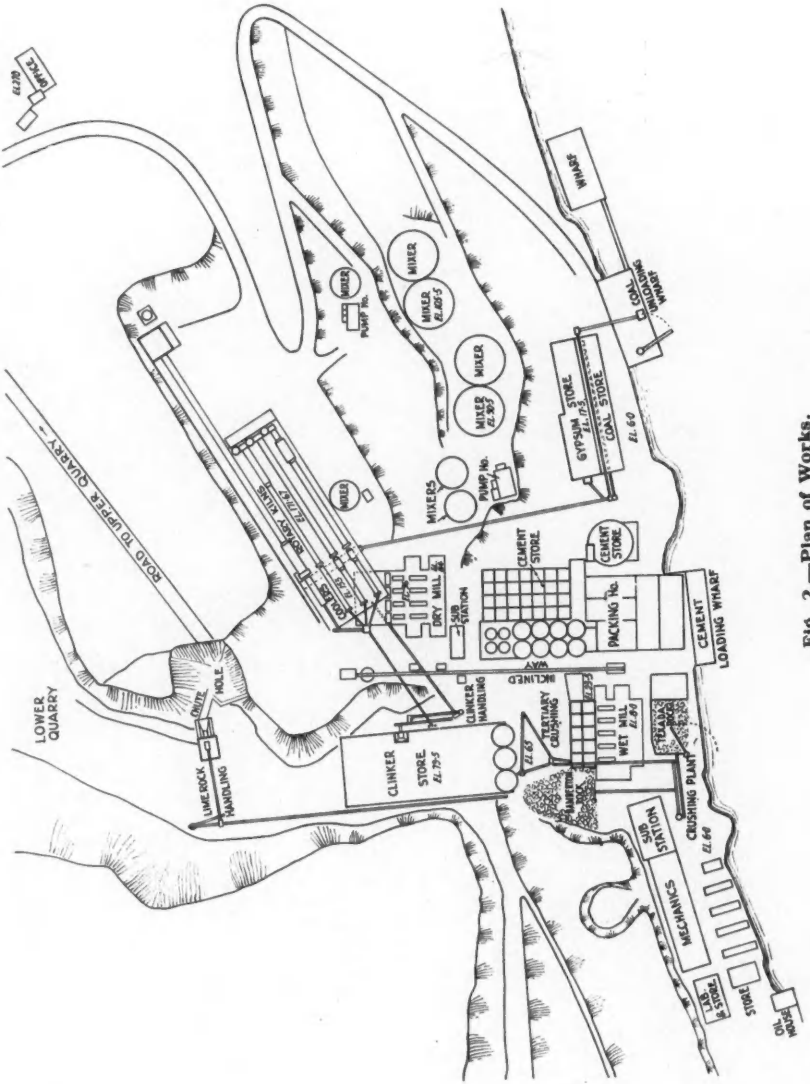


Fig. 2.—Plan of Works.

Victoria. Because the site slopes steeply to the sea, considerable use is made of gravity in transporting materials.

Cement from the Bamberton works is supplied throughout the western half of British Columbia, but mainly in and near Vancouver. Nearly all the cement is transported by sea in covered scows. Fresh water is obtained from lakes at an elevation of 1500 ft. two miles west of the works. Electricity at 60,000 volts is transformed to 550 volts for power and to 110 volts for lighting. Coal for firing the kilns is mined on Vancouver Island and transported to the works in open scows. Gypsum is quarried in central British Columbia, taken to Vancouver by rail, and shipped in open scows to Bamberton.

The plan (*Fig.* 2) shows the arrangement of the works. The elevations show

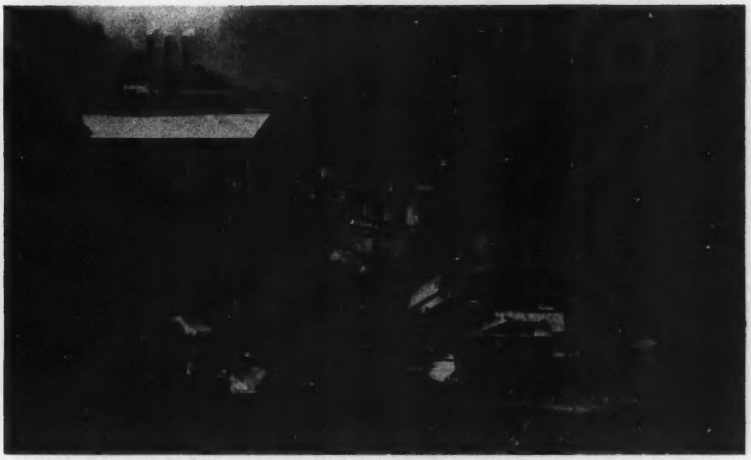


Fig. 3.—View of Works.

the slope of the site and the way gravity has been used to assist the flow of materials. A flow-diagram is shown in *Fig.* 4. Nearly all parts of the plant can be reached by road, and equipment moved to and from all departments by truck. The new electrical plant includes a 60,000-volt main substation and two smaller substations, one to supply the kiln plant and another the clinker-handling and rock-crushing departments.

Raw Materials.

Rock was originally quarried in sufficient quantity at Bamberton. From 1928, however, additional high-grade limestone has been quarried at Blubber Bay on Texada Island, 125 miles north-west of Bamberton. At Texada the limestone formation slopes gradually from the seashore, the faces now worked being about 75 ft. high. The rock averages 92 per cent. $CaCO_3$ content.

A Bucyrus 27T churn-drill bores vertical holes 6 in. diameter 27 ft. apart in a straight line 22 ft. behind and parallel to the face to 7 ft. below the bottom of

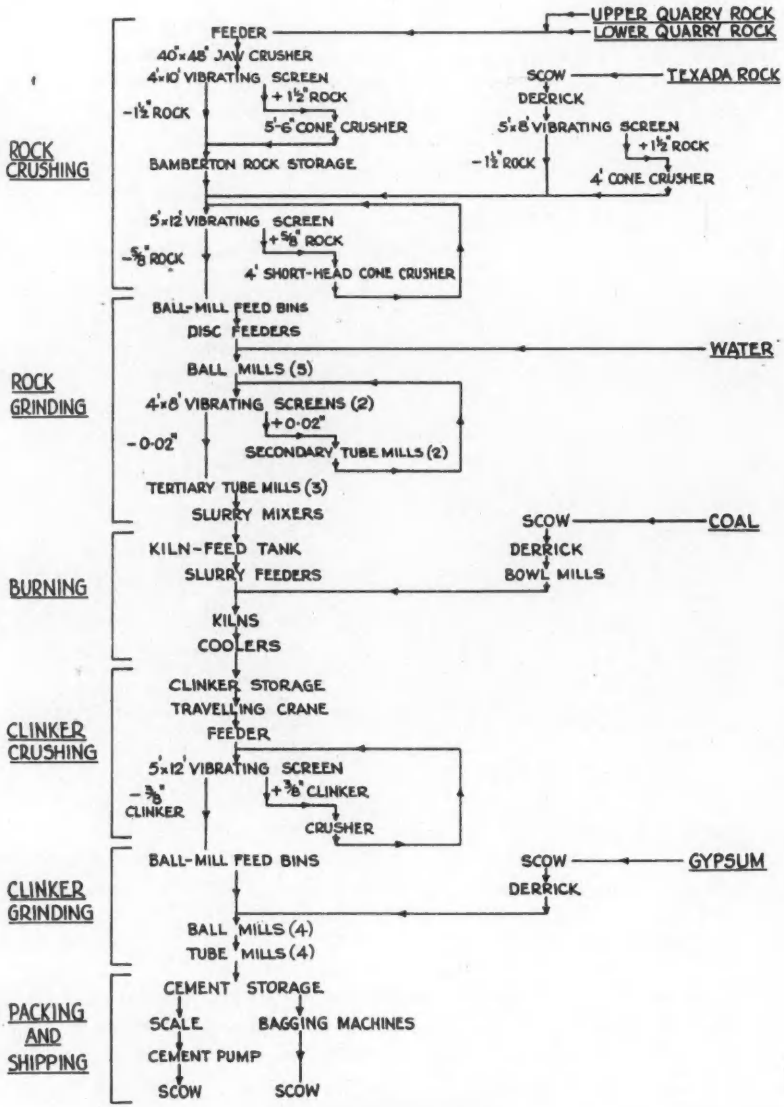


Fig. 4.—Flow Diagram.

the face. The quantity of explosive used is 0·64 lb. per cubic yard of rock. The required quantity of explosive is spaced, by sand-stemming between the charges, according to the profile of the face and the hardness of the rock; Primacord detonating fuses are used. Two electric caps, wired in series, are taped to the Primacord at the top of each hole, and the leads from the cap are connected to a timing machine which detonates each hole along the face at predetermined intervals. A period of 0.015 second is the usual interval between detonating charges. This system of primary blasting gives better fragmentation, resulting in increased production at lower cost, compared with the drill system formerly used.

Two shovels, a 1½-cu. yd. P. & H. and a 1¾-cu. yd. Lima, load the rock into four 15-tons rear-dump Euclid trucks which take it 1000 yd. to a 36-in. by 48-in.

Fig. 5.—Primary Crushing Building.

jaw crusher (supplied by the Dominion Engineering Co.) which reduces it to minus 6 in. A bucket-elevator lifts the crushed rock to a 24-in. overhead conveyor-belt which deposits it in a storage area with a capacity of 30,000 tons. A belt-conveyor in a tunnel below the storage conveys the rock directly to open scows of 500 tons capacity at the loading wharf.

Two quarries near the plant are being used; at one quarry, which has been used since the plant was built in 1912, the face is 145 ft. high and about 100 ft. wide. The floor is 80 ft. above sea level. The supply of usable rock here is nearly exhausted, but there is a considerable quantity below the present floor level.

The floor of the other quarry is some 225 ft. above the first. This quarry has been developed during the past three years, and is estimated to contain ten years'

supply. As at the Texada quarry, primary blast-holes are made with a Bucyrus 27T well drill. The spacing of the holes, the depth of the burden, and the timing vary somewhat from those used at Texada, but otherwise the system is the same. In the lower quarry, a Bucyrus 25B electric shovel with a 1¼-cu. yd. bucket loads rock into three Koehring Dumptors which transport it 200 yd. to the crusher at the entrance to the quarry. In the upper quarry a 1¾-cu. yd. Marion electric shovel loads 15-tons rear-dump Euclid trucks, which tip the rock into storage above the crusher (*Figs.* 5 and 6).

A Stephens-Adamson pan-feeder 60-in. wide by 12-ft. long discharges the rock into a 40-in. by 48-in. Buchanan jaw crusher. The rate of feed can be controlled by increasing or decreasing the speed of the feeder. The product of this crusher smaller than 6 in. passes over a 4-ft. by 10-ft. double-deck Dillon vibrating screen.

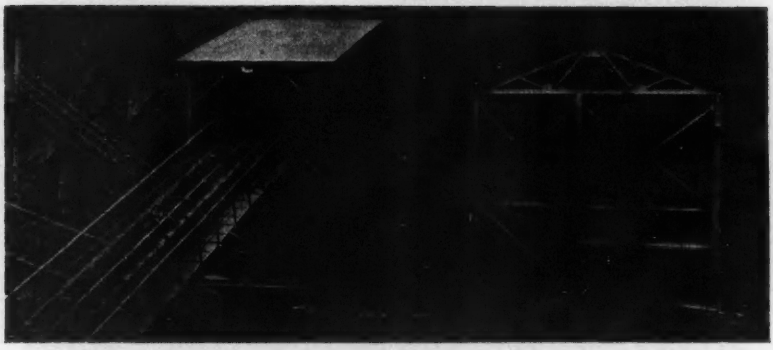


Fig. 6.—Conveyor from Primary Crusher on left. Secondary Crusher on right.

The oversize from the screen feeds a 5½-ft. Symons standard cone crusher which reduces it to minus 1½ in. All handling is by belt conveyors. The product from the Symons crusher and the fine material which goes through the screen both fall on to the same belt conveyor which discharges into the storage area south-west of the wet mill building.

Limestone from Texada is unloaded by a derrick crane with clamshell bucket from open scows and deposited in the Texada rock storage area at the waterfront crushing plant. This rock passes over a 5-ft. by 8-ft. Stephens-Adamson vibrating screen. The oversize from the screen is reduced from minus 6 in. to minus 1½ in. size in a 4-ft. standard Symons cone crusher and is discharged to a 24-in. conveyor belt which takes the crushed rock and the fines from the screen on to the tertiary crushing system. A belt-conveyor in a tunnel under the rock storage at the works discharges the stored rock into the waterfront system for transport to the third crushing stage. The tertiary crusher, a 4-ft. short-head Symons machine, reduces the rock from minus 1½ in. to minus ⅝ in. size. This crusher is in closed circuit with a 5-ft. by 12-ft. Dillon screen. All these crushers, except the waterfront

machine, were installed as part of the recent expansion programme. By providing the mills with a finer feed, the tertiary crusher increased the output of the existing rock grinding mill without the installation of additional grinding mills.

Rock Grinding (Wet Mill).

The rock-grinding equipment consists of: (1) bins for storing mill feed, (2) five ball mills for coarse grinding, (3) screens for close-circuiting the secondary mills, and (4) five tube mills for fine grinding. Each ball mill has two concrete feed bins, one for "high-calcium" rock containing 90 per cent. $CaCO_3$, and one for "low-calcium" rock containing silica, iron and alumina. The rock is discharged from the bottom of each bin to disc feeders, by means of which the proportions of high-calcium and low-calcium rock are adjusted.

Fig. 7.—Kiln No. 4.

The five 8-ft. by 6-ft. ball mills were supplied by Ernest Newell & Co., Ltd., when the plant was built in 1912; the mills have a central shaft, and are driven by 160-h.p., 600 r.p.m., Sandycroft cascade motors through a flat-belt drive to the mill pinion shaft. The mills are charged with eight tons of 3½-in. diameter forged alloy-steel balls and revolve at 23 r.p.m. Rock is fed to the mills at the rate of 18 tons per hour, and is ground to about 50 per cent. passing a 200-mesh sieve. Bucket-elevators lift the product to two 4-ft. by 8-ft. Dillon vibrating screens with openings of 0.02 in. The oversize from these screens is fed to two 6-ft. by 24-ft. Newell tube mills acting as secondary mills. These mills are charged with 30 tons of 1¾-in. and 1½-in. diameter balls in separate compartments, and are driven by 300 h.p. motors through reduction gears. The fines from the screens are further ground in three 6-ft. by 24-ft. Newell tube mills with 30 tons of 1½-in. and 1-in balls in separate compartments. Drives are the same as for the secondary mills. These mills produce slurry with a fineness of 85 per cent. passing a 200-mesh sieve.

From the tube mills, at an elevation of about 10 ft. above sea-level, the slurry is pumped to four mixing tanks, 66 ft. diameter by 8 ft. deep, half way between sea-level and the kilns, which are at an elevation of about 170 ft. In one tank mechanical mixing only is used; in the other three mechanical and air agitation are combined. Two mixers, 40 ft. in diameter and 41 ft. deep, with both types of agitation, are used for slurry blending. Wilfley centrifugal pumps are used for blending and for pumping the slurry to two kiln-feed tanks in which mechanical and air agitation are used; one of these tanks is 32 ft. diameter by 38 ft. deep and the other 40 ft. diameter by 41 ft. deep.

Burning.

The dimensions of the four kilns are: No. 1, 185 ft. long by 8 ft. 10 in. diameter; No. 2, 200 ft. long by 8 ft. 10 in. diameter with a 10-ft. diameter burning zone and a drying zone 12 ft. diameter by 18 ft. long; No. 3, 185 ft. long by 9 ft. diameter with 10-ft. diameter burning zone; No. 4, 350 ft. long by 10 ft. 2 in. diameter with 11-ft. 6-in. diameter burning zone (this is the new Vickers-Armstrong kiln, *Fig.* 7).

The older kilns have four tires, except No. 2 which has five. The rollers have grease-lubricated brass bearings. The shells are of $\frac{1}{2}$-in. steel plate except in the enlarged zones where the shell is $\frac{3}{4}$ in. thick. The burning zones are lined with 6-in. bricks, and the remainder of the kiln with $4\frac{1}{2}$-in. bricks. Chain systems comprising a dense elliptical curtain followed by festoons are used to increase thermal efficiency and reduce dust losses. Kilns Nos. 1 and 3 are driven by 60-h.p. slip-ring induction motors and No. 2 by a 75-h.p. motor. Worm reduction-gears are used between the motor and the spur-gear train. The input and output sides of the worm reduction gear are fitted with flexible couplings. Induced draught in each case is provided by a James Howden Rexvane No. 18 fan. The clinker is cooled in rotary coolers 7 ft. in diameter and 70 ft. long. The coal is dried, ground, and classified in Raymond bowl mills, and hot air for drying the coal is drawn from the top of each kiln hood.

The new kiln turns on six tires with oil-lubricated, self-aligning, brass bearings on the roller shafts. The shell in the burning zone is 1 in. thick and $\frac{7}{8}$ in. in the remainder of the kiln. The kiln is lined with 6-in. bricks for the first two-thirds of its length and with $4\frac{1}{2}$-in. bricks for the remainder. The chain system is a curtain and festoon arrangement similar to that in the old kilns. The kiln is driven by a 150 h.p. variable-speed motor through V-belts to a reduction gear. A torsion-shaft connects the reduction-gear with further spur-gear reductions to the kiln girth-gear. A Keith Blackman fan, driven by a 200-h.p. induction motor through a V-belt drive and fluid coupling, provides induced draught. Coal is ground in a Raymond bowl mill, similar to, but larger than, those with which the smaller kilns are equipped. A 6 ft. by 44 ft. inclined-grate air-quenching Fuller cooler (*Fig.* 8) reduces the temperature of the clinker to 200 deg. F. at the discharge. The cooler consists of alternate fixed and sliding grates stepping down towards the discharge end, over which the clinker is moved by moving grates. The discharged clinker passes over a grizzly which deflects large lumps

into a hammer-mill; the impact throws the broken lumps back into the cooler for further cooling.

Coal is unloaded from open scows by a derrick crane with a clamshell bucket and taken by an 18-in. belt-conveyor to an open storage area with a capacity

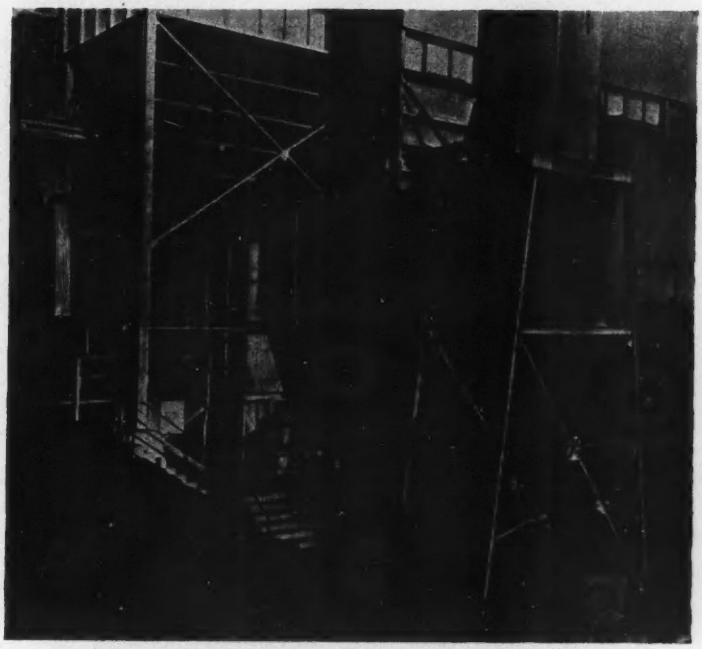


Fig. 8.—Part of Cooler and Dust Collector.

of 2000 tons. The coal is delivered to an 18-in. conveyor in a reinforced concrete tunnel under the storage pile, which transfers it to an 18-in. conveyor 400 ft. long at a 22 deg. slope discharging into the boot of a Redler elevator. This elevator lifts the coal 50 ft. to a flat belt with travelling plough which feeds the hopper-bottomed steel bins above the Raymond bowl mills. These bins are filled daily.

All the kilns are fully equipped with recording and control instruments supplied by the Bailey Meter Company. Flue-gas oxygen analysers indicate changes in the oxygen content within thirty seconds of a change in the fuel or in the setting of the draught. The draught at the hood of the small kilns is controlled automatically. Kilns Nos. 1 and 2 have variable-speed motors on the induced-draught fans; kiln No. 3 has a louvre damper on the inlet side of the fan. In each case the required setting is applied by pneumatic controls actuated by changes in the draught at the kiln hood. The flow of air is propor-

tional to the draught at the hood, so that constant conditions of combustion are maintained. However, in the case of kiln No. 4, where the Fuller cooler is used, some of the fluctuations of draught at the hood are caused by variations in the thickness of the clinker on the grates. These changes have the opposite effect on the quantity of air flowing, that is, an increase in draught due to a condition in the cooler actually indicates a reduced air flow. For this reason, automatic hood-draught control has not been found practical on this kiln. The exit-gas temperature of each kiln is recorded. The temperature of the mixture of fuel-and-air leaving the Raymond bowl mills is automatically controlled.

Fig. 9.—Dust Collector on left. Clinker Store on right.

The speed of the slurry feeders is maintained proportional to the speed of the kiln by means of G.E.C. Thymotrol control.

In addition to these instruments, kiln No. 4 has a kiln-speed recorder, an induced-draught fan inlet-temperature recorder, and a mid-kiln temperature recorder consisting of a thermocouple about 150 ft. from the feed-end of the kiln and which passes through the kiln shell and lining. The leads from the thermocouple are connected to two rigid copper conductors mounted on insulators around the kiln shell. As these conductors rotate with the kiln they make continuous contact with carbon brushes, which are in turn connected with the recorder on the firing platform. This recorder does not give a true reading, but indicates relative changes in temperature.

The speed of the Fuller cooler is controlled automatically according to the temperature of the clinker on the grate at the feed end. The control system increases the speed of the grate so as to reduce the thickness of the bed of clinker

if the clinker is too hot, and reduces the speed of the grate so as to increase the thickness of the bed of clinker if it is below the control temperature, as indicated by a thermocouple. The cooled clinker from each kiln is conveyed to a distribution box arranged so that the output of any or all the kilns may be passed over a short belt-conveyor fitted with a scale. Clinker which is not weighed by-passes the weighing-belt and is conveyed direct to storage.

A multiclone dust collector is installed between the outlet of the new kiln and the induced-draught fan. Recovered dust is withdrawn from hoppers under the collectors by screw-conveyors discharging into a bucket-elevator which lifts

Fig. 10.—Clinker Crushing.

it to a surge bin from which a short screw-conveyor discharges the dust into a vortex bowl at the top of the slurry feed-pipe.

Clinker Crushing.

The clinker storage building (*Fig.* 9), built during the recent extensions, has a capacity of about 33,000 tons. The building is 90 ft. wide and 225 ft. long, with reinforced concrete buttressed walls 30-ft. high on which is a steel structure carrying crane rails and the roof. A travelling-bridge crane, with a 4-cu. yd. clamshell bucket, spans the building and travels its full length. The bucket places the clinker into a hopper from which it is withdrawn by means of a short variable-speed belt conveyor. The clinker first passes over a 5-ft. by 12-ft. Dillon

vibrating screen which separates the material exceeding $\frac{3}{8}$ in. in size. The oversize material is passed through a Telsmith Gyrasphere crusher (*Fig.* 10) and again passed over the screen. A magnet suspended above the conveyor removes tramp iron. Clinker which passes through the screen is discharged to an inclined belt-conveyor which takes it to the bins which supply the finishing mill; these bins contain sufficient material for about 24 hours' grinding. Bins for gypsum are in front of the clinker bin and directly above the ball-mill feeders; these bins hold three days' supply of gypsum. The gypsum is handled by the same conveyor system as that which takes coal to the kiln storage bins.

Clinker Grinding (Dry Mill).

The finish-grinding plant consists of four ball mills and four tube mills operated in open circuit. Before the recent plant expansion, only three sets of mills were operated. To increase the output of the clinker-grinding mill, the fourth set of mills was placed in operation and the Telsmith crusher circuit, as previously described, was installed to reduce the size of the feed to the ball mill. This installation has increased the mill output by about 22 per cent. Clinker and gypsum are fed by Hardinge constant-weight feeders to 6 ft. by 15 ft. 6 in. ball mills charged with 25 tons of 3-in. and $3\frac{1}{2}$-in. forged alloy-steel balls. The ball mills are driven by 250-h.p. induction motors with belt drives to the mill-drive pinion shafts. Three of the mills have endless flat belts and the fourth, recently put into operation, is driven by multiple V-belts. The product of the ball mills is discharged by gravity to 6-ft. by 24-ft. tube mills charged with 28 tons of $1\frac{1}{2}$-in. and 1-in. diameter balls in separate compartments. These mills are driven by 300-h.p. synchronous motors. The capacity of each mill is $12\frac{1}{2}$ tons of cement per hour. Screw conveyors move the finished product to storage.

Packing and Transport.

A storage capacity of about 27,000 tons of cement is provided by reinforced concrete silos, bins, and a large steel tank used for storing oil before coal-firing was adopted. Screw conveyors withdraw the cement from storage, and bucket-elevators discharge it into bins supplying three packing machines. Before entering the bin the cement passes through a rotary screen which removes foreign material. Four-tube Bates machines are used to fill paper bags. Practised men can fill more than 1200 bags per hour; the operators are relieved every 20 minutes, and the man not operating a machine keeps the other supplied with empty sacks. As the filled sacks come off the belt conveyors from the machines they pass down a chute to a table. Four men load the sacks by hand on to pallets; two of the men load 50 sacks on to a pallet on one side of the table; then the other two men load another pallet on the other side of the table while the first two men rest. In the meantime, fork-lift trucks remove the loaded pallet and replace it with an empty one. The lift-trucks carry the loaded pallets into covered scows which have a capacity of 14,000 bags each. The demand for loose cement has greatly increased during the past year, and an automatic batch-weighing scale and a Fuller Kinyon pump for loading carriers have been installed.

Some Problems in the Operation of Rotary Kilns.

The maintenance of rotary kilns, particularly where specialist aid is not available, is discussed in "Revue des Matériaux" for July 1953. The following is a summary of the article.

A certain amount of vibration cannot be avoided, but it can be absorbed if the foundations are massive enough. Unabsorbed vibration increases with time, and leads to excessive play between the driving gear and pinion. There may also be unsuspected settlement of the foundation.

It is not unusual for a kiln to become warped. If a new kiln has become unevenly heated due to exposure to the rays of the sun, it should be turned through 180 deg. so as to expose the underside. Distortion may result from overheating of the upper part of the shell after a sudden stoppage. Small distortions can be remedied by turning the kiln through 180 deg.; in cases of more serious distortion four or five turns may be necessary, pausing for three or four minutes each time with the bulge uppermost. In very severe cases it is suggested that the centre-line of the deformed kiln be plotted and the bearing supports adjusted so that on rotation the kiln remains more or less on the centre-line. The bearings are adjusted to give a small pressure on each bulge, and the kiln is then fired and rotated.

Bulges are frequently caused by "hot spots" in a kiln. Small bulges can be patched when the surrounding shell is in good condition. Large bulges impairing alignment and causing weakness necessitate replacement of either a riveted section or the necessary length of a welded kiln. Bulges near the tyres cause the tyres to ride from side to side on the rollers. An unorthodox remedy is to detach the tyre, turn the kiln to the best position, and refix the tyre. Burning of the shell at the point of discharge close to the sealing rings is normally countered by the use of special steels, but it is advisable to fit also an external covering of ordinary mild steel.

In the case of old kilns having the tyres riveted to reinforcing rings, or even to the shell itself, differential expansion between the tyre, the shell, and the rivets leads to "play" at the rivet heads. If re-riveting entails removal of lining bricks it is expensive and should be avoided by welding. The old rivet-holes can be plugged with weld metal and new supporting blocks welded to the kiln.

Grooves in tyres or rollers may arise from incorrect alignment of the roller or from faulty metal. A certain amount of unevenness on a tyre can be corrected by changing the roller, but in bad cases an emery wheel set in a roller base may be used to grind the tyre while the kiln is rotated. Tyre troubles may sometimes be traced to uneven loading of sections of the kiln or to worn gear teeth, but they are more often due to warping of the kiln or incorrect alignment of the bearings.

Tyres can break for various reasons. One rare fracture occurred when the lining had become thin and heavy rain cooled the tyre and shrunk it in relation to the hot shell. A hot spot under the tyre is a likely cause, so that it is advisable

to keep the lining in repair. Loose supports may lead to a fractured tyre, and they should be tightened whenever they show signs of becoming loose.

A cracked tyre can be temporarily repaired satisfactorily by welding. A weld can be made across the whole width of the tyre by drilling and strapping the two sides, chamfering at the crack, and welding in the chamfer. The metal must be preheated over an area of at least 8 in. on each side of the weld and annealed afterwards for at least twelve hours. A tyre fractured into pieces can be reassembled by fixing a series of overlapping steel plates on each side; these are held together and to the tyre by threaded studs. When a tyre is to be replaced it is much easier to use one made in sections.

A kiln is often thrown out of alignment when one roller journal is thought to be worn and is changed without changing the other. The ammeter of the kiln motor is the best indication of incorrect roller adjustment. Some reasons for irregular kiln rotation are as follows: unsuitable foundations; rollers out of alignment with tyres; gear and pinion too tight or too loose; incomplete electrical contact at studs controlling a variable-speed motor; motor operating at an unsuitable speed; joints between sections of built-up gear not quite closed; irregular chutes of raw material in the kiln; synchronisation of several movements; deformation of the shell; capacity of kiln increased above power of motor; loss of elasticity of elastic couplings; bearing lubricant too thick; driving pinion eccentric to the mass of raw material; too much pressure between the two elastic surfaces of the sealing ring; inadequate lubrication of bearings subject to thrust.

The Cement Industry in Hungary.

THE starting of a third kiln at Hungary's oldest cement factory, at Lábatlan, has raised production there by 50 per cent. and of the whole country by 10 per cent. Modernisation of this factory, which is more than 80 years old, has been

The Hejöcsaba Cement Works, Hungary.

going on for a year, and a fourth kiln is now being installed. The largest cement works in Hungary is now nearing completion at Hejöcsaba for the production of blastfurnace and ordinary Portland cements.

The Largest Cement Works in Greece.

THE cement works at Eleusis of Société Anonyme de Ciments Titan was built in the year 1910 and is stated to be the largest in Greece now that it has been extended by the construction of a new dry-process plant working independently of the old. The new plant has a capacity of 600 tons of Portland cement per day and the total capacity of both plants is 1,000 tons per day. The following description of the new plant is taken from an article by Mr. Constantin Tsountas in the U.S.A. journal " Rock Products " for October, 1953.

The raw materials are hard crystalline limestone and clay. The extension was built in two stages, each with machinery supplied and installed by F. L. Smidth & Co., and each producing about 300 tons of cement daily.

RAW MATERIALS.—Stone is loaded in the quarry by a power shovel into dump-trucks which take it to a hopper from which it is carried by an inclined conveyor to a 150-kw. slow running hammer mill which reduces it to 10-in. size. A bucket elevator takes the crushed material to a chute in the storage area.

Drying and grinding of the raw materials are done in two air-swept mills, each 21 ft. long by 9 ft. 6 in. diameter. Each mill consists of a ball compartment and a Cylpebs compartment. The fine material is separated by an air separator, from which the coarse material is returned by a screw conveyor to the mill inlet. The circulating air is heated, for the drying of the raw materials, by an oil-fired furnace. The excess air passes through an automatic bag-type filter with nine compartments.

The material is transported from the raw mill by pneumatic pumps, over a distance of about 525 ft., to a device which automatically distributes it to four silos in such a manner that when one of the silos is full the others are filled to three-quarters, one-half, and one-quarter respectively. When a silo is full, the material is drawn off and taken to two homogenising hoppers from which it is transferred to a storage silo from which it is withdrawn by air-slides. By this means an extension of the grinding period is obtained, which reduces any fluctuation in the uniformity of the material leaving the mills.

KILNS.—The two rotary kilns are 11 ft. by 9 ft. diameter by 350 ft. long, and each has a cooler arranged circumferentially at the end. The feed and the method of adding water to the nodulising drum are coupled to the kiln motor and synchronised with it. The water content of the nodules is kept to 10 or 11 per cent. The kilns are operated with natural draught, so that the power consumption is reduced. The two kilns have cross fittings in the drying zone which reduce the loss of dust. It was found that there was 3 per cent. and 1 per cent. of dust, measured on the amount of raw product in the stacks of kilns Nos. 1 and 2 respectively. The kilns are not provided with dust filters.

The kilns are fired by oil, although coal or a mixture of the two fuels may be used. During normal operation, the heat consumption is 1035 k.cal. per kilogramme of clinker, measured on the net calorific value. The power consumption of the kiln, the primary-air fan, and the nodule drum is 8.5 kw.h. per ton of clinker.

CEMENT MILL.—The clinker is ground by a 24-ft. by 36-ft. Unidan mill and a 24-ft. by 29-ft. Unidan mill. Both of these clinker mills are arranged for direct grinding and are fitted for internal water cooling. To ensure a constant temperature of the cement and prevent condensation in the bag-type filter, the addition of water is controlled by contact thermometers and interlocking devices between the mill motors and the water pumps.

The power consumption of the new plant is 90 kw.h. per ton of cement.

The first plant started production in August, 1951, and the second in January, 1952.

A view of part of these works was shown on page 52 of this journal for July, 1953.

New Cement Works in Pakistan.

In February last the Govenor-General of Pakistan laid the foundation stone of a new cement factory at Daud-Khel. The works is sponsored by the Pakistan Industrial Finance Corporation, and the plant is being supplied by Canada under the Colombo Plan.

Cement Production in Norway.

It is proposed to install new cement plant in Norway in order to increase production from about 150,000 tons a year to about 210,000 tons. It is hoped to complete the new works by the end of the year 1955.

New Cement Works in Spain.

New cement factories are to be built at Torredonjimeno, near Jaen, and at Teruel.

Cement Production in Spain.

In the year 1953 the production of Portland cement in Spain was 2,520,000 tons, an increase of 244,000 tons compared with the previous year. It is expected that in two years time the production will be 4,000,000 tons. A new works is to be built near Andorra, and another in the south of Spain.

Cement Production in Portugal.

The production of cement in Portugal in the first half of the year 1953 was 367,000 tons, compared with 284,000 in the same period in 1952.

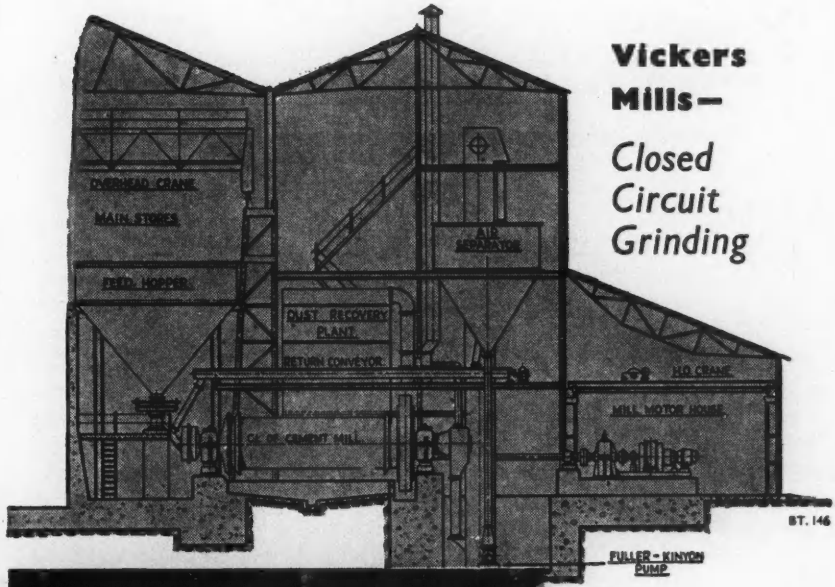
MISCELLANEOUS ADVERTISEMENTS.

SCALE OF CHARGES.

Situations Wanted, 3d. a word; minimum 7s. 6d. Situations Vacant, 4d. a word; minimum 10s. Box number 1s. extra. The engagement of persons answering these advertisements subject to the notification of Vacancies Order, 1952. Other miscellaneous advertisements, 4d. a word; 10s. minimum. **Advertisements must reach this office by the 5th of the month of publication.**

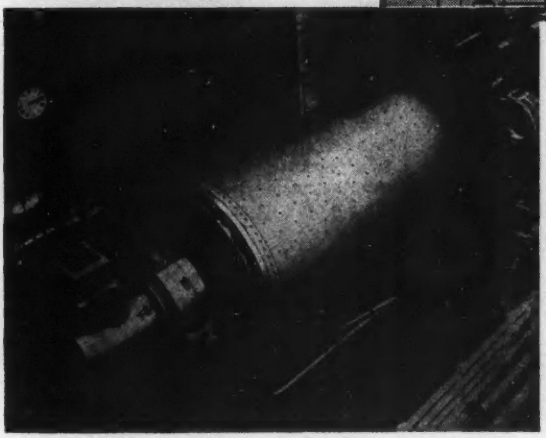
SITUATION VACANT.

SITUATION VACANT.—Engineer, age 32-35, required for London office of manufacturers of cement works equipment. Cement works or pneumatic conveying experience an advantage but not essential. Pension scheme. Write details of age, experience and salary required.—Box 1237, Cement and Lime Manufacture, 14, Dartmouth St., London, S.W.1.



Vickers Mills—

Closed Circuit Grinding



Though a 'closed circuit' makes it easier to control production to a specific fineness, consistent accuracy depends upon the plant being reliable. The trouble-free running synonymous with Vickers mills demonstrates, in fact, that there is no substitute for skill and experience backed by manufacturing capacity.

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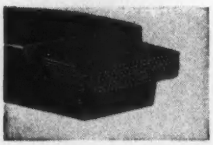
For bashing a ball over a net or for a V-belt drive in a factory, the same rule applies. Unequal sharing of work is always likely to arise. Even with Goodyear V-belts — the best there are — old belts do not match up with new ones. With proper care and maintenance Goodyear belts will give you years of perfect, reliable service. Constant technical experiment and years of experience dealing with industrial problems have made Goodyear the greatest name in rubber, and that name guarantees the reliability of every product which bears it.

HOW TO GET LONGER LIFE FROM INDUSTRIAL RUBBER PRODUCTS

Compiled by Goodyear's own technicians the Goodyear Maintenance Manual is the best practical guide to getting longer and more efficient life from industrial rubber equipment. Please write to Dept. O.2, Goodyear Tyre & Rubber Co. (G.B.) Ltd., Wolverhampton, for your free copy.



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These are the ideal drives for longer centres and normal speeds with high starting torques, stalls and pulsating or shock loads. Goodyear Rayon Cord V-Belts withstand fatigue or shock with equal facility. Their natural elasticity avoids snapping under sudden jolts, and both stretching and creeping are kept to a minimum.

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The Cement Industry in South and Central America.

THE following details of cement works in South and Central America are abstracted from the U.S.A. journal " Pit and Quarry " for September, 1953. Unless otherwise stated Portland cement is produced at these works. The capacities are given in tons per year.

ARGENTINA.—The total production of Portland cement in the year 1952 was about 1,370,000 tons and about 430,000 tons were imported.

Loma Negra, S.A., Compania Industrial Argentina. Works at Olavarria, Buenos Aires : 450,000 tons ; wet process ; four raw mills ; three 226 ft. by 10 ft. and one 224 ft. by 12 ft. oil-burning kilns ; five clinker mills. Works at Frias, Santiago del Estero : 120,000 tons ; wet process ; one 380 ft. by 12 ft. oil-burning kiln.

Compania Argentina Cemento Portland. Sierros Bayas, Buenos Aires : 384,000 tons ; dry process ; five 175 ft. by 10 ft. kilns. Works at Parana, Entre Rios : 167,000 tons ; wet process.

Calera Avellanada, S.A. San Jacinto. 70,000 tons ; dry process ; one 100 ft. by 10 ft. kiln.

Corporacion Cementera Argentina, S.A. Total annual capacity of three works 350,000 tons. Works at Estacion Kilimetro 7, Cordoba : Dry process ; 200 ft. by 7 ft. kiln. Works at Capdevila, Mendoza : Dry process ; 226 ft. by 8 ft. kiln. Works at Pipinas, Buenos Aires : Wet process ; 347 ft. by 11 ft. 6 in. kiln. Pozzolana cement is also produced at Capdevila and Pipinas.

Iggam S.A. Industrial : Rodriguez del Busto, Cordoba. 32,000 tons of white Portland cement ; 30 ft. by 7 ft. three-compartment primary crushing mill ; 220 ft. by 7 ft. 6 in. kiln ; two-compartment clinker mill.

Cia. Sudamericana de Cemento Portland, Juan Minetta e Hijos, Ltda. Works at Dumesnil, Cordoba : 195,000 tons ; wet process ; 223 ft. by 12 ft. kiln. Works at Pauqueua, Mendoza : 163,000 tons of ordinary Portland and white cements ; dry process ; three kilns, 79 ft. by 7 ft., 98 ft. by 9 ft., and 260 ft. by 9 ft. Works at Campo Santo : 81,500 tons ; dry process ; 260 ft. by 9 ft. 6 in. kiln.

Works at Puebla Santa Juana, G.M. de Commodore Rivedavia. 106,000 tons ; wet process ; kilns 328 ft. by 10 ft. and 328 ft. by 8 ft. 6 in.

BOLIVIA.—Sociedad Boliviano de Cemento. Viacha. 46,500 tons ; dry process ; 18 ft. by 6 ft. and 22 ft. by 5 ft. 6 in. raw ball mills ; two 100 ft. by 7 ft. kilns ; 18 ft. by 6 ft. and 22 ft. by 5 ft. 6 in. clinker mills.

BRAZIL.—The total production of Portland cement in the year 1952 was 1,440,000 tons, and 730,000 tons were imported.

Cia. Nacional de Cimento Portland. Guaxindiba, Rio de Janeiro. 450,000 tons ; four kilns.

Cimento Aratu, S.A. Aratu, Bahia. 122,500 tons ; wet process ; two 33 ft. by 7 ft. wet grinding mills ; two 300 ft. by 9 ft. kilns ; two 33 ft. by 7 ft. clinker mills.

Cia. de Cimento Portland Paraiso. Campos, Rio de Janeiro. 255,000 tons; wet process; three raw mills; three oil-fired kilns; two clinker mills.

Cia. de Cimento Portland Barrosa. Barbacena, Minas Gerais. 163,000 tons; wet process.

Cia. Cimento Rio Grande do Sul Cimensul. Puerto Alegre, Rio Grande do Sul. 130,000 tons; wet process.

Incisa-Industria e Comercia de Cimento, S.A. Sorocabana, Sao Paulo. 65,000 tons; 40 ft. by 7 ft. tube mills; 203 ft. by 9 ft. kiln; 11 ft. 6 in. by 9 ft. 3 in. calcinator.

Cia. de Cimento Vale do Paraiba. Volta Redonda, Rio de Janeiro. 25,000 tons of slag cement; dry process.

Cia. Cimento Portland Itau. Works at Itau des Minas, Minas Gerais: 84,000 tons; wet process. Works at Cidade Industriale, Minas Gerais: 160,000 tons.

S.A. Industrios Votorantim. Santa Helena, Sao Paulo. 600,000 tons; wet process; five kilns.

Cia. de Cimento Portland Poty. Sao Jose, Pernambuca. 137,000 tons; wet process; two kilns.

Cia. Paraiba de Cimento Portland S.A. Joao Pessoa, Paraiba. 130,000 tons; wet process.

The following works are stated to be under construction or are proposed to be built (annual capacity in tons in parentheses). At Corumba, Mato Grasso (80,000). Cachoeiro Itampemirim, for Cia. Cimento Portland Valpini (180,000). Goiana, for Cia. Cimento Portland Goias (80,000). Massoro, for Cia. Cimento Portland Massoro (80,000). Imbitiba, for Cia. Brs. Ligantes Hidraulicos (224,000). Cap Benito, for Cia. Paulista Cimento (98,000). Sao Roque, for Projeto Maia Lello. Cordeiro, for Cia. Fluminense Cimento Portland. Curitiba, for Cia. Cimento Portland Parana. Salvador, for Cia. Bahia de Cimento Portland. Parada Lucas, for Cia. Construtora Capua y Capua (32,500 tons of white cement). Itapera, for Cia. de Cimento Portland Maringa (81,500). Pedro Leopoldo, for Cia. Cimento Portland Caue (106,000). Itapesoca, for Itapesoca Agro Industriale, S.A. (97,000). Araxa for Cia. de Cimento Portland Ponte Alta (49,000). Rio de Janeiro, for Cimento Portland Branco de Brazil, S.A. (36,500). Brusque, for Cia. Catarinese de Cimento Portland (81,500). Rio Branco, for Cia. de Cimento Portland Rio Branco (81,500). Perus, for Cia. Brasileira de Cimento Portland Perus (350,000).

CHILE.—The latest official information is for the first nine months of the year 1951 when 380,258 tons of Portland cement were produced. Production in 1952 is expected to have exceeded 800,000 tons of which 100,000 tons were authorized for export.

Sociedad Fabrica de Cemento de El Melon. La Calera. 570,000 tons; dry process.

S.A. Juan Soldado Consolidada. La Serena. 38,300 tons; wet process; four 199 ft. by 9 ft. 6 in. kilns.

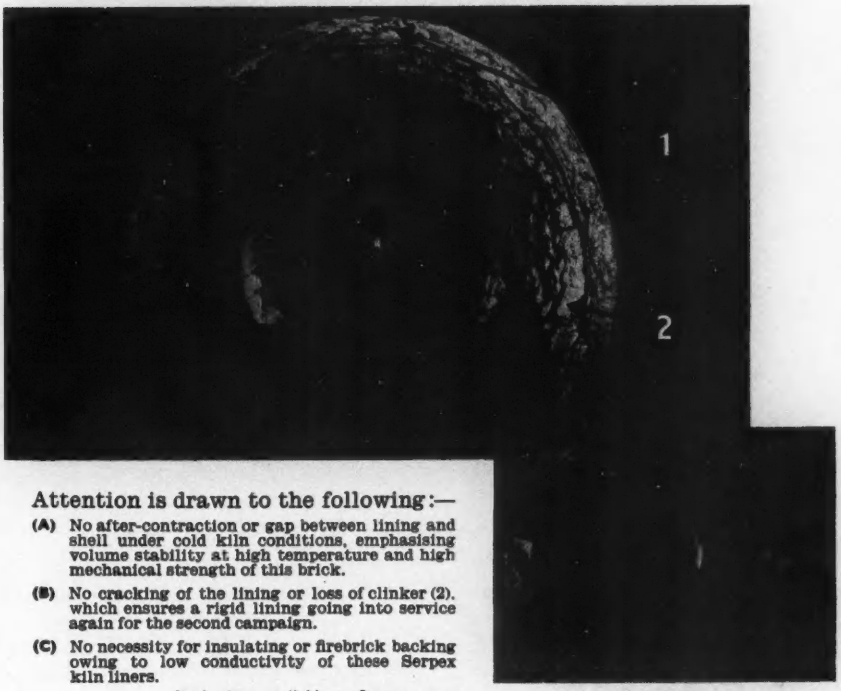
Cemento Cerro Blanco de Polpaico, S.A. Polpaico, Santiago. 240,000 tons; wet process; two 12 ft. by 9 ft. tube mills; one 11 ft. by 8 ft. tube mill; two 300 ft. by 11 ft. kilns; two 22 ft. by 8 ft. clinker tube mills.

SERPEX 'A'

LINERS for ROTARY KILNS

. . . still good after full Campaign !

The pictures show a Serpex 'A' lining (1) after a full campaign run in the burning zone of a rotary kiln taken off for examination and inspection. The lining is retained and goes into production for a further campaign.



Attention is drawn to the following:—

(A) No after-contraction or gap between lining and shell under cold kiln conditions, emphasising volume stability at high temperature and high mechanical strength of this brick.

(B) No cracking of the lining or loss of clinker (2). which ensures a rigid lining going into service again for the second campaign.

(C) No necessity for insulating or firebrick backing owing to low conductivity of these Serpex kiln liners.

Stock sizes available to fit any rotary kiln lining from 8 ft. to 13 ft. diameter.

Photographs by courtesy of The Portland Cement Manufacturers

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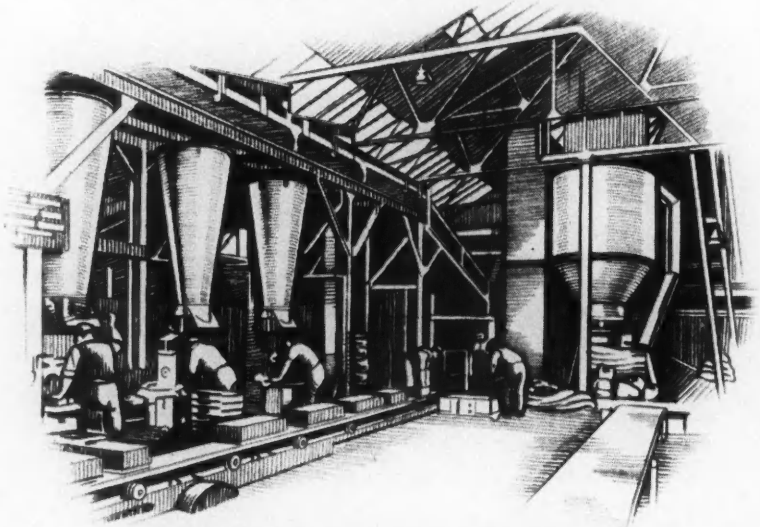

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STAFFS

COLOMBIA.—The latest production figures are for 1952 when about 700,000 tons of Portland cement were produced of which about 12,000 tons were exported, mostly to Venezuela.

Compania de Cemento Argos. Medellin, Antioquia. 110,000 tons ; wet process ; two 145 ft. by 5 ft. kilns ; one 236 ft. by 7 ft. 6 in. kiln.

Cementos del Valle, S.A. Cali, Del-Valle del Cauca. 162,000 tons ; wet process. (Additional equipment being installed to increase production to 260,000 tons per year.)

Cementos del Caribe, S.A. Barranquilla. 97,000 tons ; wet process ; 13 ft. by 9 ft. ball mill ; two 300 ft. by 10 ft. kilns ; 30 ft. by 8 ft. compeb mill.

Cementos el Cairo, S.A. El Cairo, Antioquia. 91,000 tons ; wet process.

Marmoles y Cementos del Nare, S.A. Works at Puerto Berrio, Medellin : 182,000 tons ; wet process ; one 240 ft. kiln and one 275 ft. kiln. The Company is building a white cement works at Medellin with a capacity of 36,500 tons a year.

Cia. de Cementos Portland Diamante. Works at Apulo, Cundimarca ; 130,000 tons ; wet process ; two oil-fired kilns. Works at Bucaramanga ; Santander: 32,500 tons ; wet process ; oil-fired kiln.

Fabrica de Cemento Samper. La Liberia, Cundimarca. 270,000 tons ; wet process ; 210 ft. by 10 ft. and 415 ft. by 11 ft. 6 in. kilns.

ECUADOR.—La Cemento Nacional. Guayaquil. 100,000 tons ; dry process ; 27 ft. by 7 ft. raw ball mill ; two 100 ft. by 6 ft. 6in. and one 150 ft. by 8 ft. kilns ;

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Typical installation in a limestone quarry
COMPRESSED AIR DRILLING MACHINE DK9
• FOR BLAST-HOLE DRILLING
• WATER OR AIR FLUSHING
• LIGHT WEIGHT
• HIGH DRILLING SPEEDS
E.g. 30 ft. hole 3" diameter in 18 minutes in limestone.
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24 ft. by 7 ft. two-compartment clinker ball mill. New works are proposed at Rio Bamba for Cemento Chimborazo, S.A., and at Cerro Azul for Fabrica de Cementos Cerro Azul, S.A.

PARAGUAY.—Industrial, Comercial y Financiera Vallemi. Puerto Vallemi. 33,000 tons.

PERU.—Cia. Peruana de Cemento Portland. Altocongo 365,000 tons. An extension to this works to increase production by 110,000 tons a year is under construction.

Works are being constructed at Pacasmayo for Compania Nacional de Cemento Portland del Norte, S.A. (120,000 tons), and at Chilca for Cia. de Cemento Chilca, S.A. (92,000 tons).

URUGUAY.—Compania Uruguaya de Cemento Portland. Sayago. 265,000 tons ; wet process ; four 187 ft. by 9 ft. kilns.

Compania Nacional de Cementos, S.A. Pan de Azucar, Maldonado. 34,000 tons of white cement ; wet process.

VENEZUELA.—C.A. Fabrica Nacional de Cementos. La Vega Caracas. Capacity to be increased to 540,000 tons by the end of 1954 ; dry process ; four kilns.

Cemento Carabobo Sucra. Valencia. 105,000 tons ; wet process.

C.A. Venezolana de Cementos. Works at Pertigalete, Anzotegui : 275,000 tons ; wet process. This works is said to be the first to use gas turbines for the generation of electrical power, four such turbines, generating 14,000 kw., being used. A new kiln is being installed to increase the annual production to 390,000 tons. Works at Maracaibo, Zulia : 180,000 tons ; wet process ; two kilns. Works at Barquisimeto, Zulia : 14,750 tons ; dry process. A new works with a capacity of 81,000 tons is to be constructed.

C.A. Cementos Tachira. San Cristobal. 49,000 tons ; wet process.

GUATEMALA.—Cementos Novella, S.A. La Pedrera. 60,000 tons ; dry process ; 60 ft. by 6 ft., 100 ft. by 7 ft., and 167 ft. by 7 ft. oil-fired kilns.

PANAMA.—Cementos Panama, S.A. Panama City. 110,000 tons ; 13 ft. by 9 ft. raw ball-mill ; two 300 ft. by 10 ft. kilns : 30 ft. by 8 ft. clinker mill.

NICARAGUA.—Compania Nacional Production de Cemento, S.A. San Rafael del Sur. 60,000 tons ; wet process.

EL SALVADOR.—Cemento de El Salvador, S.A. Playa los Flores, Acajutla. 54,000 tons ; wet process ; 13 ft. by 9 ft. raw mill ; 300 ft. by 10 ft. kiln ; 29 ft. by 8 ft. clinker mill. Raw materials used are marine shells and volcanic pumice.

CUBA.—La Compania Cubana Cemento Portland. Cayo Mason. 365,000 tons ; wet process.

DOMINICA.—Fabrica Dominicana de Cemento. Ciudad Trujillo. 273,000 tons ; wet process.

HAITI.—Le Ciment de Haiti. Port-au-Prince. 73,000 tons ; wet process.

JAMAICA.—Caribbean Cement Co., Ltd. Rockfort. 100,000 tons ; wet process ; 36 ft. by 8 ft. three-compartment mill ; 300 ft. by 10 ft. oil-fired kiln ; 36 ft. by 8 ft. clinker mill.

TRINIDAD.—Rugby Portland Cement Co., Ltd. Morichal. 110,000 tons.

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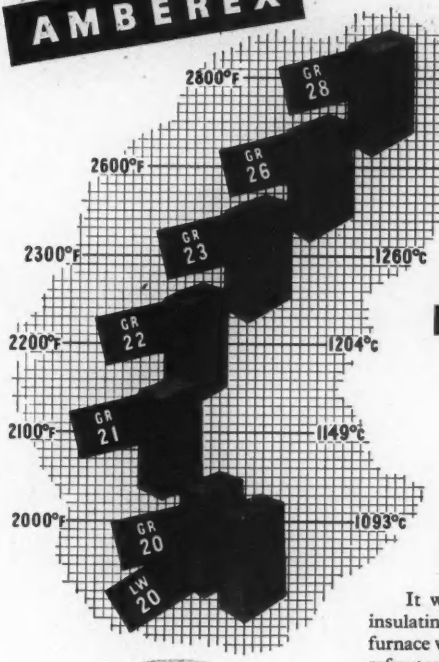

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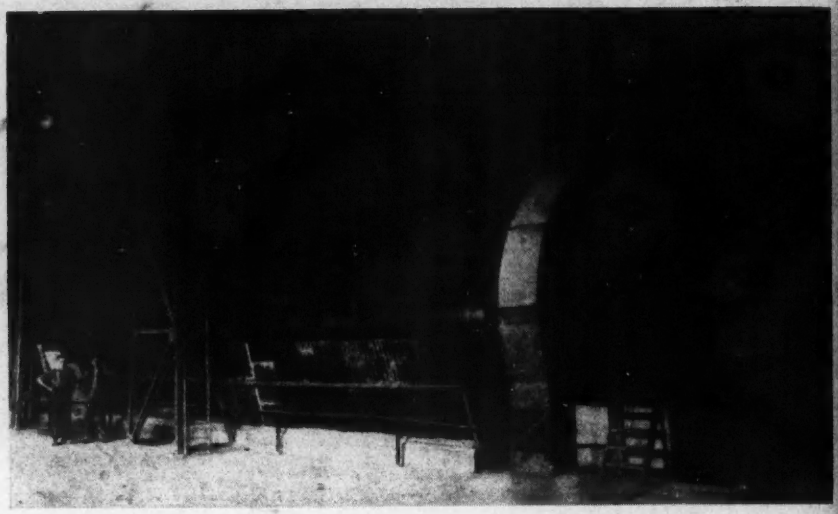

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